

12 **EUROPEAN PATENT APPLICATION**

21 Application number: 86309165.8

51 Int. Cl.⁴: **A 22 B 3/06**

22 Date of filing: 25.11.86

30 Priority: 25.11.85 NZ 214315

43 Date of publication of application:
10.06.87 Bulletin 87/24

84 Designated Contracting States:
FR GB

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54 **Animal stunning equipment.**

57 Animal stunning equipment suitable for use with sheep or other small livestock includes a restrainer - conveyor (36) comprising one or more pair of continuous belt or slat conveyors having inclined operating surfaces facing each other to define a substantially V-shaped passageway in which an animal can be restrained and conveyed towards automatic stunning means. The stunning means is arranged so that one or more sets of electrodes (30) which are moveable between a stunning position and a withdrawn position, are set at rest to form a barrier in the path of the moving animal to stun the animal immediately it comes into contact with the waiting electrodes. The conveyor is temporarily stopped when the animal contacts the electrodes. After stunning has occurred, the electrodes are de-activated and moved to the withdrawn position out of the conveyor path to enable the conveyor to be restarted and eject the stunned animal.

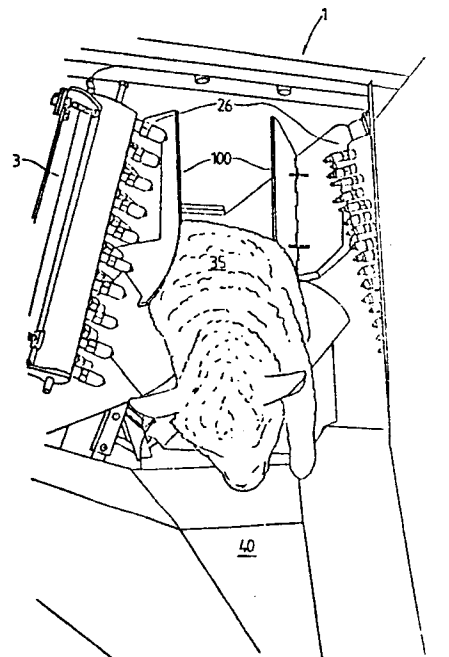


FIG. 8

1 This invention relates to animal stunning equipment. **0225148**

2 Animal stunning equipment is required to stun an animal prior to
3 slaughter. To the present time such stunning equipment has generally
4 included a conveyor which conveys an animal to a particular stunning
5 position at which point the stunning electrodes will close onto a
6 portion of the animal and grip it before releasing again to let the
7 stunned animal through. Such a system is described in NZ Patent
8 201402.

9 Problems have been experienced with such stunning equipment in
10 synchronising the arrival of the animal at the stunning position with
11 the closing of the electrodes.

12 Problems have also been experienced with such stunning equipment,
13 particularly when used on horned stock, with the electrodes failing to
14 make proper contact with the animal, or becoming entangled with the
15 animal.

16 Other examples of prior art stunners are shown in :

17 USP 4,361,932 NIJHUIS

18 USP 3,996,644 ANDERSON

19 USP 4,468,837 NIJHUIS

20 Nijhuis has suggested moving the electrodes with the animal (eg a pig)
21 as it moves along a restrainer conveyor or arranging the electrodes
22 overhead to pivot out of the way as the animal moves through the
23 stunner zone. Anderson teaches the holding of an animal captive in a
24 pen then moving a conical stunner into contact with the animal's head.
25 To move the electrodes towards a stationary animal or move it with a
26 moving animal is unsatisfactory as it requires accurate contact
27 between the animal and the electrodes.

28 It is an object of the present invention to provide stunning equipment
29 which can overcome or at least obviate disadvantages with stunning
30 equipment available to the present time and which can ensure that the
31 stunning electrodes are in position for contact with the animal.

32 Further objects of this invention will become apparent from the

1 following description.

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2 According to one aspect of the present invention there is thus
3 provided stunning apparatus, including one or more sets of electrodes
4 which are moveable between a stunning position and a withdrawn
5 position for use with transport means, whereby an animal may be moved
6 into stunning contact with said electrodes when said electrodes are at
7 rest at said stunning position, and wherein in use said electrodes may
8 move out of said stunning position, out of contact with said animal,
9 and into said withdrawn position.

10 According to another aspect of the present invention there is thus
11 provided animal stunning apparatus comprising sets of electrodes, said
12 sets of electrodes being in use positioned substantially in an animal
13 stunning position prior to the arrival of an animal at said position.

14 Preferably said sets of electrodes included a pair of sets of
15 electrodes which in normal use, when at rest at said stunning
16 position, have electrically conductive contact points disposed across
17 a line of approach of said animal, some of said contact points facing
18 substantially into said line of approach, others of said contact
19 points facing substantially across said line of approach.

20 Further aspects of this invention which should be considered in all
21 its novel aspects will become apparent from the following description
22 given by way of example of a possible embodiment thereof and in which
23 reference is made to the accompanying drawings wherein;

24 Figure 1: shows diagrammatically a front perspective view of the
25 animal stunning apparatus according to one possible embodiment of the
26 invention;

27 Figure 2: shows a cross-sectional view along arrow A-A of Figure 1;

28 Figure 3: shows a plan view of the right-hand stunning head of Figure
29 1;

30 Figure 4: shows a view along arrows C-C of Figure 3;

31 Figure 5: shows a plan view along arrows D-D of Figure 1;

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- 1 Figure 6: shows very diagrammatically a sheep about to be carried into
- 2 contact with the stunning electrodes;
- 3 Figure 7: shows a view from the front of Figure 6;
- 4 Figure 8: shows an animal being discharged from the stunning apparatus
- 5 after the stunning operation has been completed;
- 6 Figure 9: shows transport apparatus of the present invention in
- 7 perspective view.
- 8 The present invention relates broadly to an automatic stunning
- 9 apparatus suitable for a variety of animal although of course changes
- 10 in dimension, electrical voltage and the like may be needed as one
- 11 progresses from the smallest animals up to the largest. In one
- 12 particular size the apparatus may be used without any major
- 13 modification or adjustment for a variety of animals including lambs,
- 14 sheep, goats and pigs.
- 15 The present invention will now be described by way of example and with
- 16 reference to the accompanying drawings.
- 17 The stunning apparatus is shown in Figures 1 and 2 particularly as
- 18 including a support frame 1 having a pair of transverse guide members
- 19 2 between which are shown pivotally mounted by means of pins or bolts
- 20 4 a pair of spaced apart legs 3 which by this pivotal mounting are
- 21 able to rotate in respective arcs as indicated by arrow X-X. The legs
- 22 3 are each suitably of an electrically non-conducting material such as
- 23 a high strength plastics material e.g. "Tivar" (trade mark). A pair
- 24 of wear strips 5 e.g. of plastics or the like are shown positioned on
- 25 either side of the transverse guide 2 so as to reduce wear on the legs
- 26 themselves as they open and close. The top of the left-hand leg 3 is
- 27 shown in Figure 2 being connected above the frame 1, with a link arm
- 28 11 by a clamp assembly 7 with a stub 8, end plate 9 and linkage 10.
- 29 The link arm 11 is shown pivotally connected with a linkage 12, itself
- 30 connected by means of a similar clamping assembly 7 with the right-
- 31 hand leg 3. The linkage 12 is also shown connected, see Figure 3
- 32 particularly, with an end plate 13 and via coupling 14 to a cylinder
- 33 15, the piston 16 of which is connected by coupling 17 with the end
- 34 plate 18 connected to the linkage 10 of the left-hand leg 3.

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1 This interconnection of the right and left-hand legs 3 may be seen
2 particularly from the plan view shown in Figure 5. Figure 5 also
3 illustrates the assembly at the left-hand side of the frame with the
4 frame member 1, the pair of transverse guide members 2 and the spacing
5 members 25 suitably of plastics or other suitably electrically
6 insulating material.

7 Referring particularly now to Figures 3 and 4 of the accompanying
8 drawings, the plan view of the right-hand stunning head of Figure 1 is
9 shown diagrammatically. The stunning head referenced generally by
10 arrow 26 is seen to comprise a cylindrical pipe 27 with liquid,
11 usually water, connections 28 at each end. Projecting from the pipe
12 27 are shown a plurality of electrodes 30. The electrical conduction
13 path will be enhanced by the water caused to flow through the nozzles
14 31.

15 The pipe 27 is shown having at each end thereof end plates 32 which
16 connect the electrode assembly 26 by means of bracket 33 and support
17 bolts 34 with the leg 3. The electrodes 30 are preferably splayed in
18 a horizontal arc of approximately 90° , such that some project in use
19 into the line of approach of an animal to be stunned, others project
20 across the line of approach, and others project at intermediate
21 angles. The spacing of the nozzles and electrodes 30, 31 along the
22 vertical height of the pipe 27 is such as to ensure adequate stunning
23 operation now being described.

24 As seen from Figures 6 and 7 particularly, an animal 35 such as a
25 sheep can be conveyed to the stunning apparatus frame 1 by means of
26 inclined V-belts 36 on either side of the animal 35, holding it off
27 the ground with its own weight acting to restrain its movement. The
28 belt 36 is shown as an endless conveyor passing around respective
29 inclined rollers 37 on each side of the frame 1 adjacent the stunning
30 heads 26.

31 Two sets of conveyors are preferably used, although the system might
32 be used with a single pair of conveying belts 26. In the preferred
33 arrangement, as shown particularly in figure 9, a comparatively long
34 'magazine' conveyor 38 leads onto the entrance of a shorter 'feed'
35 conveyor 36, which carries the animal 35 to the stunning apparatus
36 frame 1. The 'magazine' conveyor 38 runs at a slower speed than the
37 'feed' conveyor 36 - for example, the conveyor 38 might carry an

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1 animal 35 at a speed of 0.7 m/sec while the conveyor 36 carries the
2 animal 35 at a speed of 0.8 m/sec. The difference in speed ensures
3 that animals 35 approaching the stunning apparatus frame 1 are not in
4 contact with each other as the leading animal is stunned. As an
5 animal 35 moves onto the faster conveyor 36 from the end of the slower
6 conveyor 38, it is pulled away from the animals 35 behind it, which
7 are still moving forward at the slower speed of the conveyor 38. In
8 practice a number of animals 35 may be 'stored' on the conveyor 38,
9 and fed one at a time to the stunning apparatus by the faster conveyor
10 36.

11 A photo-cell detector 39 placed before the entrance of the 'feed'
12 conveyor 36 may be used to control the amount of movement of the
13 'magazine' conveyor 38, such that when an animal 35 is 'called' and
14 transported to the stunning apparatus, the the 'magazine' conveyor is
15 also activated until the next animal in line is brought to this
16 juncture and registered by the detector 39, whereupon the conveyor 38
17 stops.

18 For the slaughter of animals to be performed in accordance with the
19 requirement of Halal killing, and also to fit in with contemporary
20 abattoir procedures, it is necessary for no more than 10 seconds to
21 elapse from the time an animal is called, through the stunning
22 process, to sticking of the stunned animal. A two conveyor system, as
23 described above, may make this possible, by having animals held in a
24 'magazine' ready for quick and efficient transport to the stunning
25 apparatus, where a single conveyor system, into which animals are fed
26 from a pen or run, might take too long.

27 When an animal 35 is called for, the legs 3 will close to the position
28 shown in Figure 1 and 7. The animal will then be conveyed by means of
29 the pair of conveyor belts 36 to the stunning frame 1. Once contact
30 is established between the animal's head and the stunning electrodes
31 30, the conveyor 36 will be stopped and the stunning current will be
32 given for a prescribed period.

33 Preferably the electric current is running in the electrodes from the
34 moment the legs 3 have closed to the position particularly shown in
35 figures 1 and 7, ie. before the arrival of the animal 35, such that
36 the stunning is initiated at contact of the animal 35 with the
37 stunning electrodes 30, rather than after contact has been made.

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1 Preferably also, movement of the conveyor belts 36 is halted by
2 contact of the animal 35 with the stunning electrodes 30. This may be
3 achieved by a small rotational movement of the electrode assembly 26
4 relative to the bracket 33, under pressure of the animal 35 being run
5 into contact with the electrodes 30, which can be used to activate a
6 limit switch, and thereby stop the conveyor. In this way proper
7 contact between the animal 35 and the electrodes 30 may be ensured
8 before movement of the conveyor will stop.

9 As seen in Figure 8 particularly, once the stunning is completed the
10 legs 3 will open and the conveyor 36 can advance sufficiently to eject
11 the stunned animal out from the frame 1 to be received on the chute
12 40.

13 To ensure that the electrodes 30 make good physical contact with the
14 animal's head the stunning heads 26 are suitably biased into the
15 animal contact position. To this end springs 41 are shown by way of
16 example connecting the pipes 27 and the legs 3 in Figure 1 although of
17 course other biasing means may be used as required.

18 It is thus seen that in the embodiment of the invention shown,
19 controlled operation of the cylinder 15 or the like would ensure that
20 the stunning heads 26 are in their closed position ready to receive an
21 animal when it arrives at the stunning position. Furthermore, the
22 biasing of the electrode heads 26 into their animal contacting
23 position will ensure good physical contact with the animal's head, and
24 the use of water in conjunction with the stunning will ensure good
25 electrical contact.

26 Furthermore, by mounting the stunning heads 26 on an electrically non-
27 conductive leg 3 suitably of a high strength plastics material, earth
28 leakage current may be prevented.

29 If it is desirable for animals being processed to be killed by the
30 apparatus, rather than simply stunned, it may be preferred to include
31 a special electrode or set of electrodes for the purpose, rather than
32 simply increasing the voltage of the electric current used, or using
33 some other means to achieve this. In such a case the additional
34 electrode is mounted centrally at the base of the frame 1, such that
35 it may move upwards into a killing position simultaneous with closing

1 of the legs 3. The killing position is one which causes the electrode
2 in normal use to be contacted by the brisket or thorax region of an
3 animal brought to the stunning apparatus, such that the current is
4 directed to the heart of the animal, to kill it.

5 A central processing unit or other control equipment may be provided
6 so as to synchronise the opening and closing of the legs 3, the
7 movement of the conveyors 36 and 38 and the initiation and termination
8 of the stunning current.

9 Control of the operation can be fairly simple, as many aspects of the
10 process follow on, one from another, in a simple chain of events which
11 do not require timing. The length of time for which the stunning
12 current is running needs to be preset, and generally may extend for
13 approximately one and a half seconds. The current flow may be
14 monitored, and if found to be insufficient for some reason - possibly
15 an animal's horns prevent proper contact - the conveyor 36 may be
16 reversed a short way, perhaps for a period of one second, and brought
17 forward again to re-establish contact between the animal and the
18 stunning electrodes. With time periods of these lengths, three
19 attempts at stunning may be made on an animal without the slaughtering
20 process being disrupted.

21 Another operation requiring a preset time period is the short run
22 forward by the conveyor 36 after release of a stunned animal by the
23 apparatus, to discharge the animal on the chute 40.

24 The period of the entire cycle may also be automatically controlled
25 with a preset time interval, determined by the speed at which
26 subsequent operations in the slaughtering chain are performed.
27 Preferably however the call for another animal to be stunned is given
28 by an operator.

29 Movement of the conveyors does not need to be timed, as both are
30 activated at once, the conveyor 38 is stopped by sensing of a new
31 animal by the sensor 39, and the conveyor 36 is stopped by contact of
32 an animal with the electrodes 30.

33 Biased centralising head flaps 100 may be provided which assist in
34 ensuring that the head of the animal is presented to the electrodes 26
35 in the correct position. A further sprung flap (not shown) may also
36 be mounted above flaps 100 to prevent the animal's head being lifted

1 just prior to stunning. Furthermore, front and back limit stops (not
2 shown) may suitably be provided so as to determine the travel of the
3 legs 3 between their open and closed positions.

4 Where in the foregoing description reference has been made to specific
5 components or integers of the invention having known equivalents then
6 such equivalents are herein incorporated as if individually set forth.

7 Although this invention has been described by way of example and with
8 reference to possible embodiments thereof it is to be understood that
9 modification or improvements may be made thereto without departing
10 from the scope or spirit of the invention, as defined in the following
11 claims:

2 1. Stunning apparatus for use with transport means(36) in which an
3 animal can be transported towards stunning means(26), said stunning
4 means including one or more sets of electrodes(30) which are moveable
5 between a stunning position and a withdrawn position, characterised in
6 that an animal may be moved into stunning contact with said electrodes
7 when said electrodes are at rest at said stunning position, and
8 wherein in use said electrodes may move out of said stunning position,
9 out of contact with said animal, and into said withdrawn position to
10 allow the stunned animal to be moved past the stunning means.

11 2. Stunning apparatus as claimed in claim 1, wherein said sets of
12 electrodes(30) included a pair of sets of electrodes(30) which in
13 normal use, when at rest at said stunning position, have electrically
14 conductive contact points disposed across a line of approach of said
15 animal, some of said contact points facing substantially into said
16 line of approach, others of said contact points facing substantially
17 across said line of approach.

18 3. Stunning apparatus as claimed in claim 2 wherein the two sets of
19 electrodes(30) forming said pair of sets of electrodes(30) each
20 include an elongate array(26) of said electrically conductive contact
21 points(31) which when in said stunning position are oriented with the
22 long axis of each said array extending substantially vertically and
23 substantially parallel to the other.

24 4. Stunning apparatus as claimed in claim 3, in combination with said
25 transport means(36), wherein said transport means includes a
26 restrainer - conveyor(36) comprising one or more pair of continuous
27 belt or slat conveyors having inclined operating surfaces facing each
28 other, said operating surfaces forming a substantially V-shaped
29 passageway therebetween, said passageway forming said line of approach
30 of said animal.

31 5. Stunning apparatus as claimed in claim 4, characterised by
32 means(26,33) to detect contact between said electrodes(30) and an
33 animal moving in said passageway and means to deactivate movement of
34 said restrainer-conveyor or parts thereof.

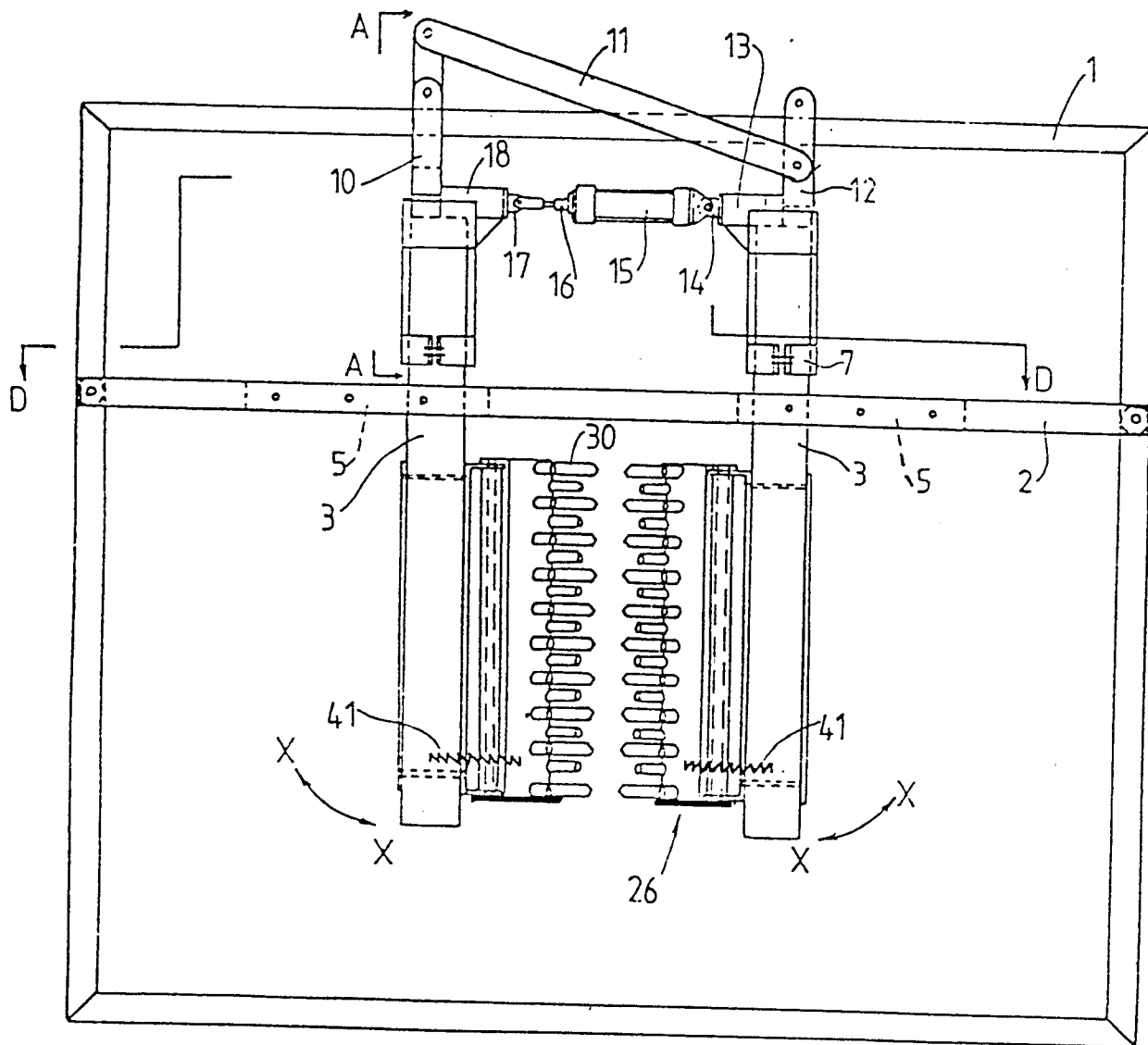
1 6. Stunning apparatus as claimed in any one of claim 5, characterised
2 by said sets of electrodes(30) being mounted for rotational movement
3 between said stunning position and said rest position.

4 7. Stunning apparatus as claimed claim 6, characterised by control
5 means which initiates electrification of said sets of electrodes(30)
6 prior to contact of an animal with said electrodes(30).

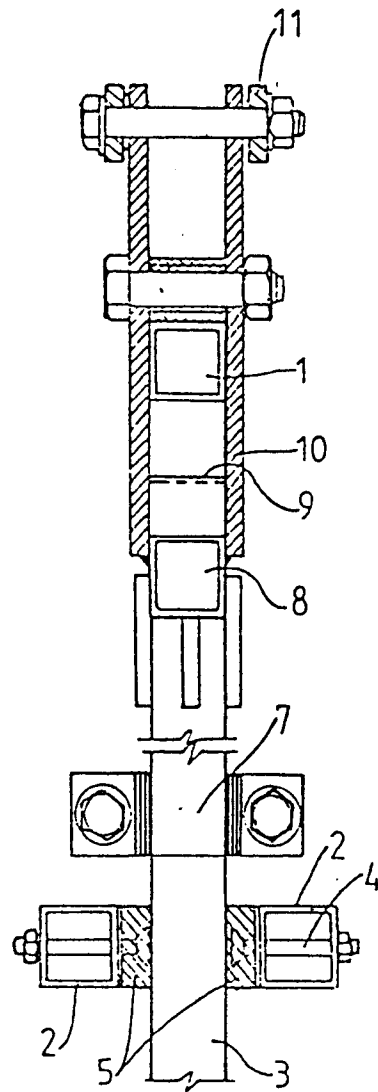
7 8. Stunning apparatus as claimed claim 7, further characterised by
8 centralising guides(100) adjacent said stunning position, adapted to
9 direct said animal or parts thereof into a particular orientation at
10 said stunning position.

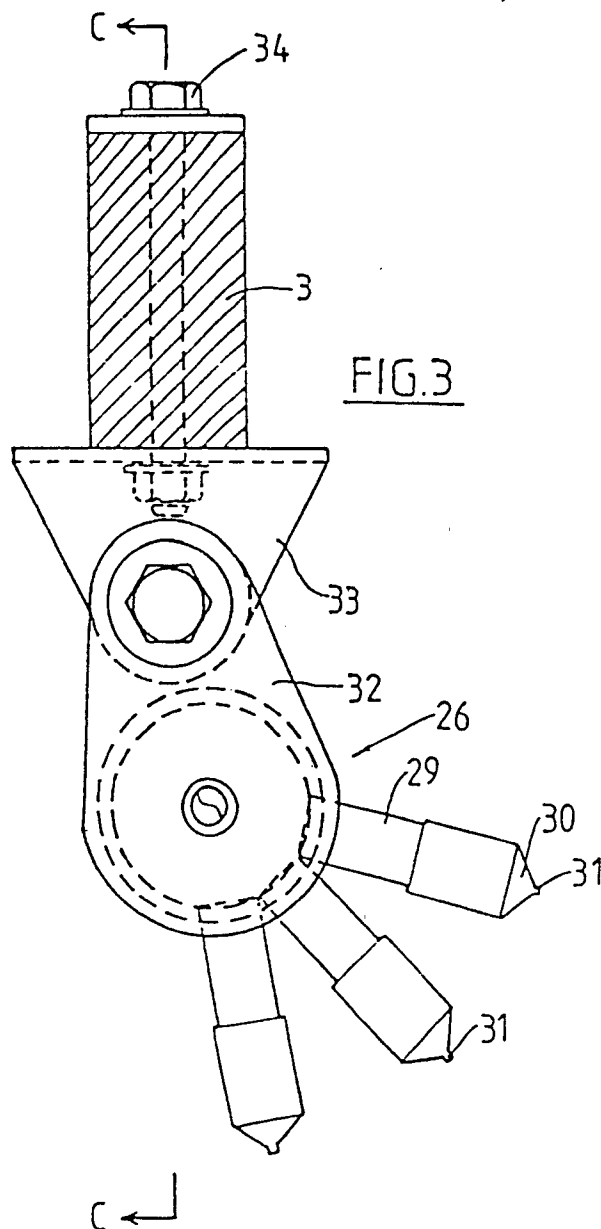
11 9. Stunning apparatus as claimed in claim 8, wherein said guides(100)
12 comprise biased hingedly or otherwise flexibly mounted members.

13 10. Stunning apparatus as claimed in claim 9, further characterised by
14 a single electrode or set of electrodes moveable between a rest
15 position and a killing position, wherein said killing position is
16 centrally located in the line of approach of said approach of said
17 animal, and wherein said single electrode or set of electrodes is
18 adapted to receive and carry an electrical charge which in normal use
19 is lethal to a contacted animal, and wherein in normal use an aspect
20 of said killing position is that an animal brought to said killing
21 position by said transport means will contact said electrode or set of
22 electrodes with its brisket or thorax region.

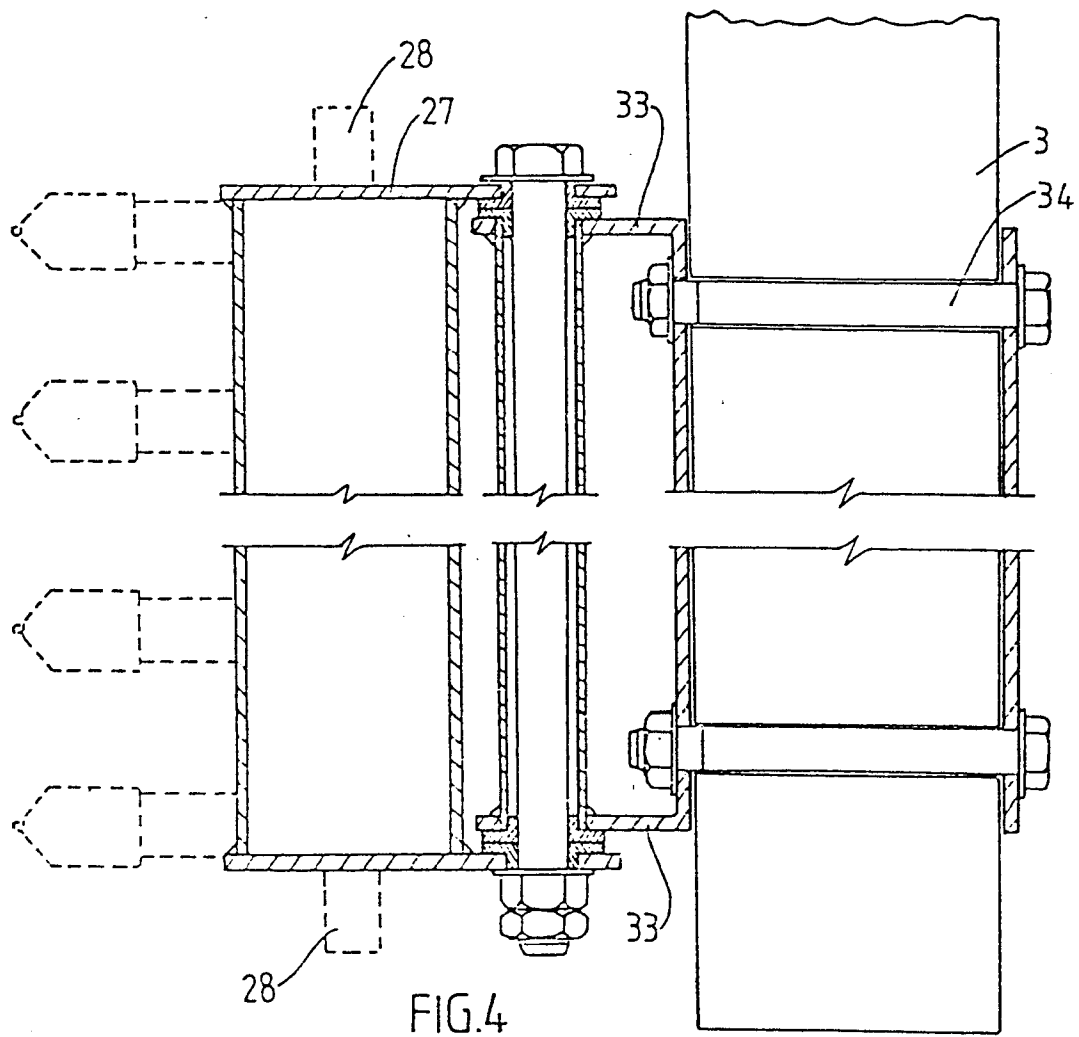
FIG.1

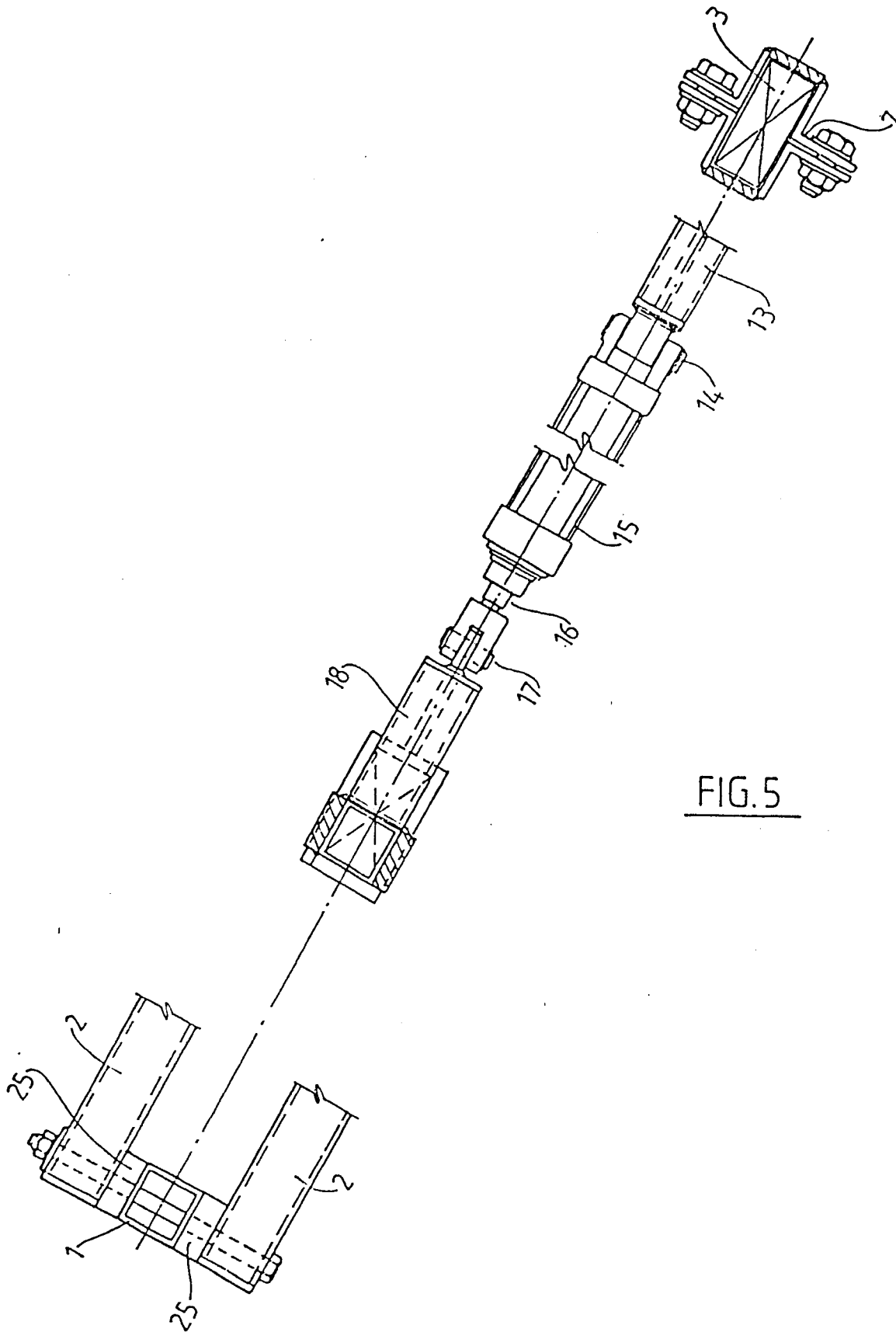
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FIG. 2

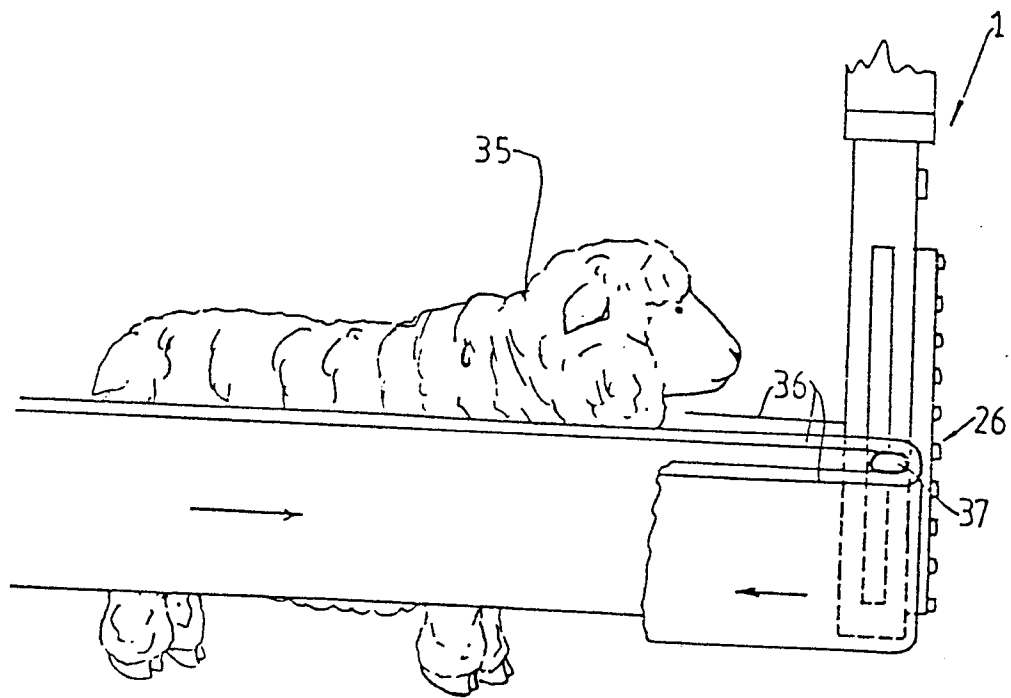


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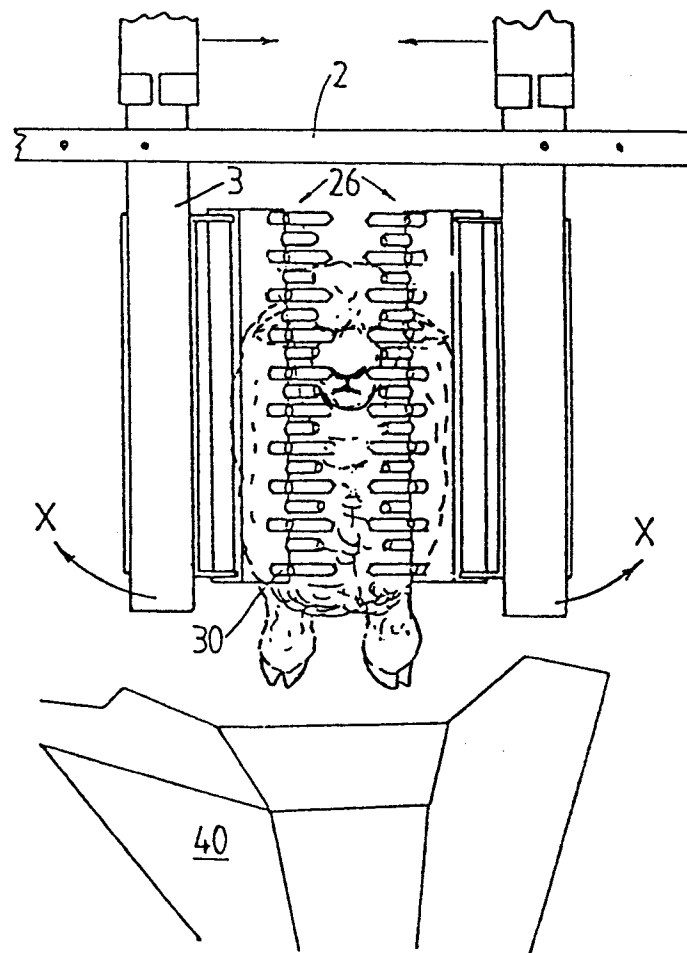
FIG. 5

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FIG. 6

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FIG. 7



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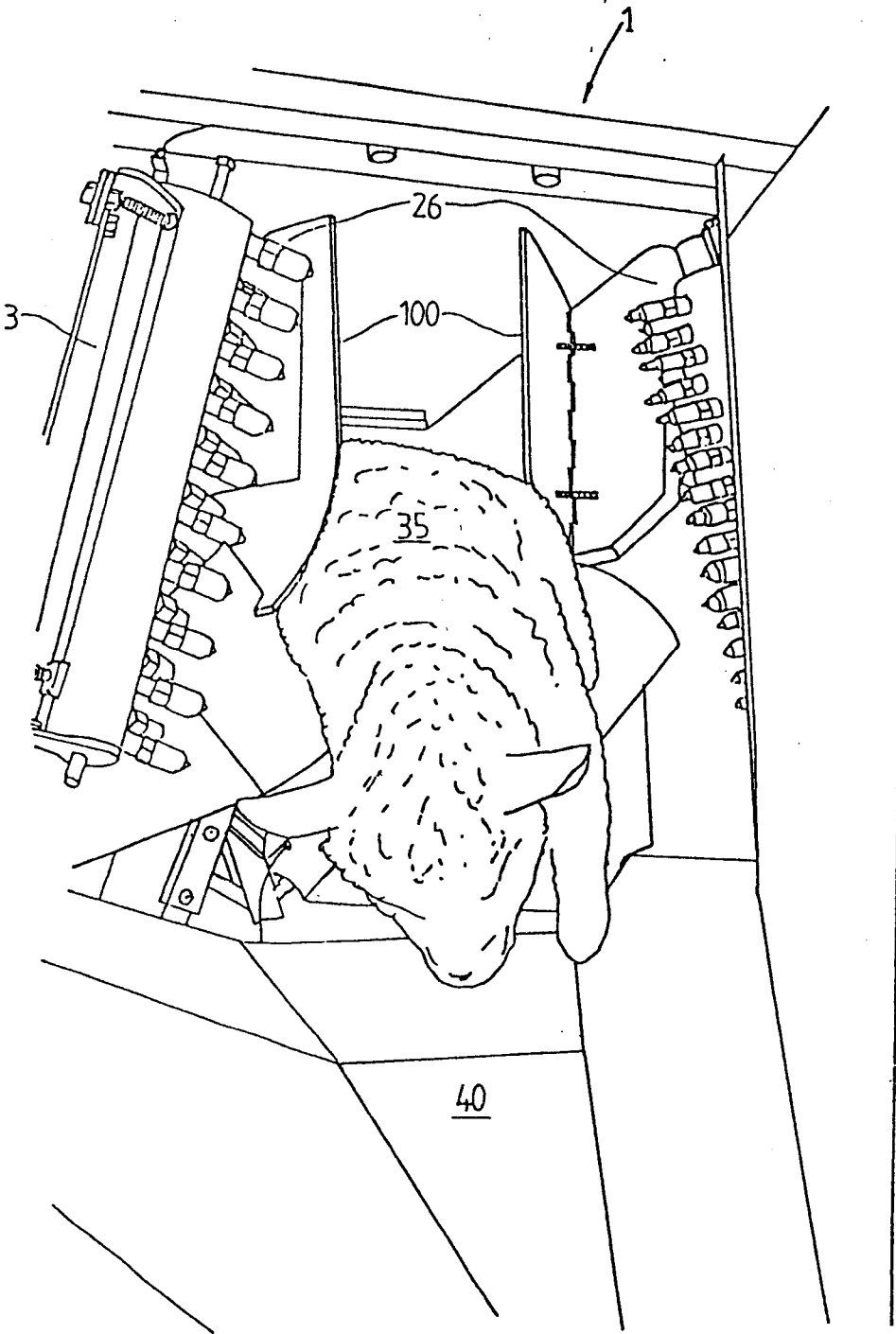


FIG. 8

FIG. 9

